



The Australian Electricity Network: A Story of two unassuming days in March

April 2023



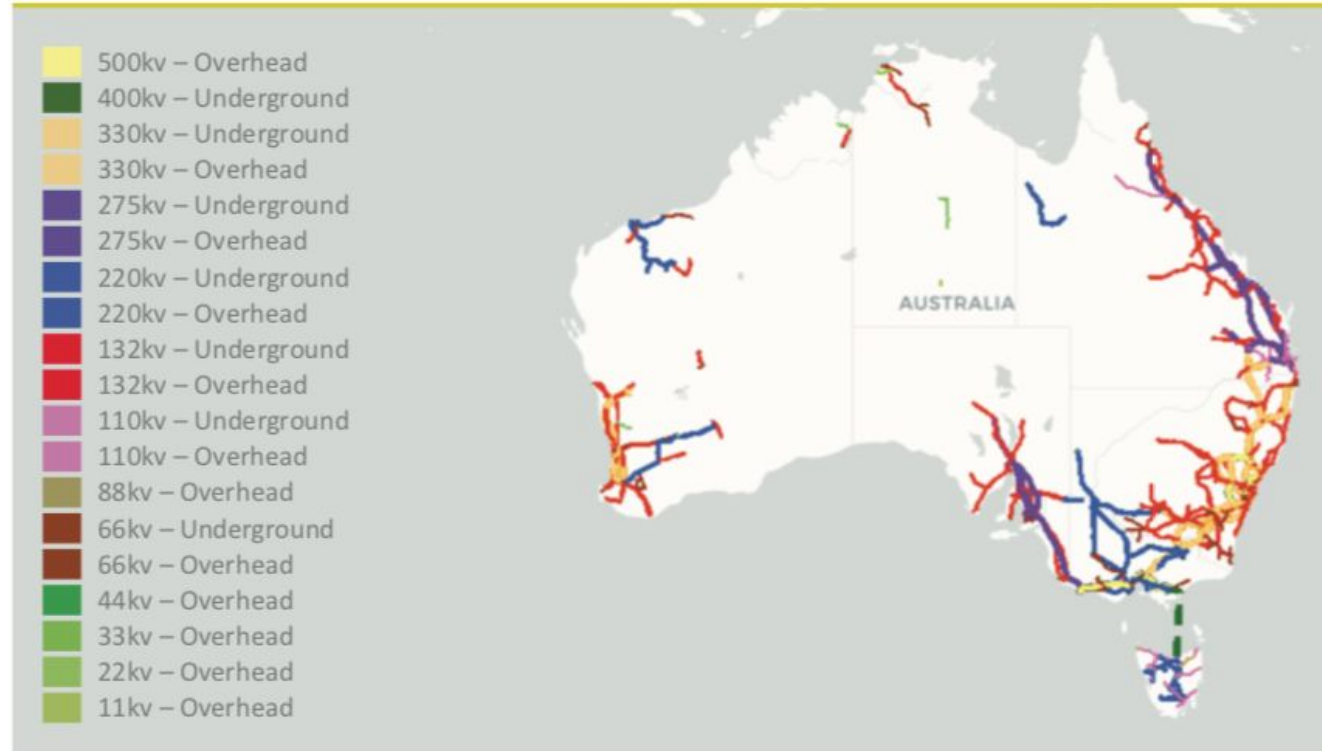
Background₂

Quick Facts

- The Australian electricity network extends about 918,000 km
- 99.95% reliability, to date
- One of the largest interconnected electricity networks in the world
- WA & NT are isolated from the rest of the country

The Network(s)

Australia's transmission networks



Source: Australian Renewable Energy Agency

Ownership

and the transmission and distribution businesses became regulated "natural monopolies."

The first electricity privatisations were in Victoria between 1995 and 1997, then South Australia in 1999 and then NSW from 2008. Western Australia and the NT remain separate from the interconnected NEM.

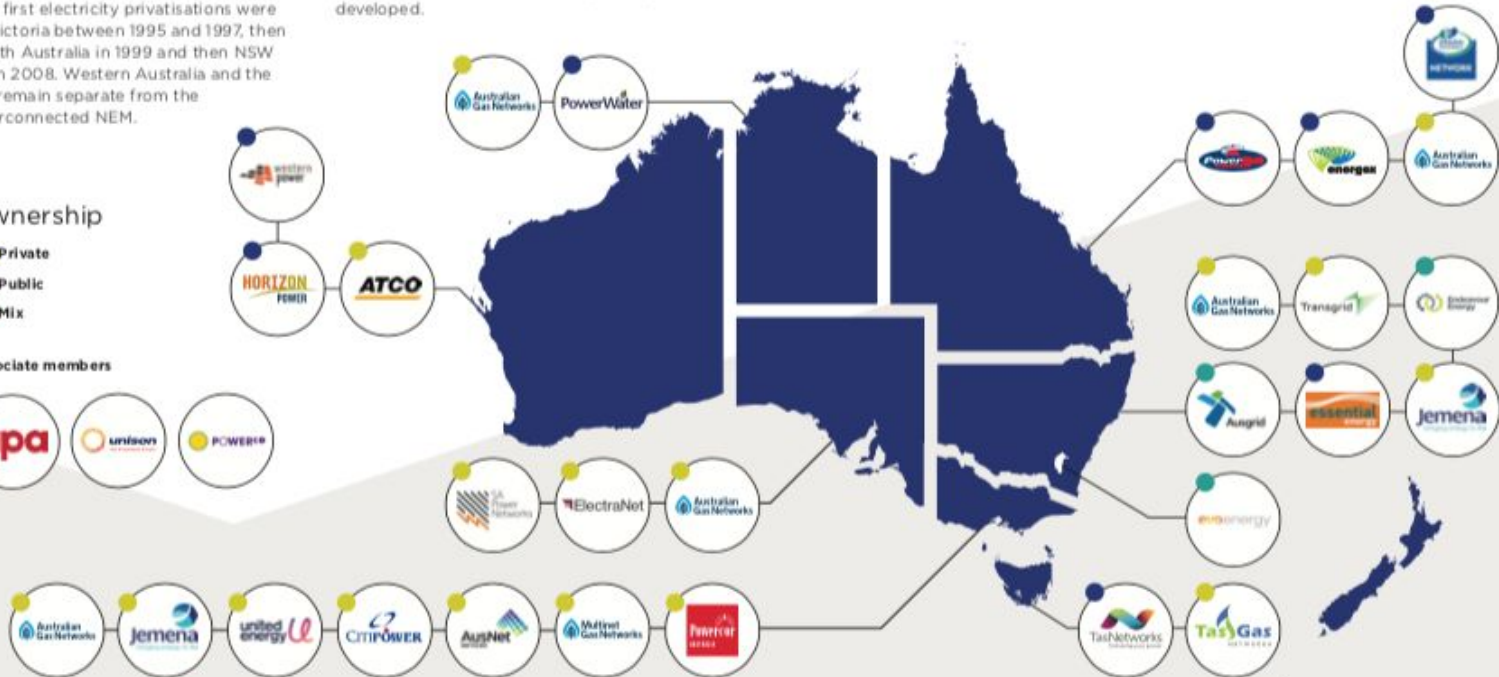
1997, 2000 and 2006.

The main gas networks across NSW, Tasmania and the ACT were all privately developed.

Ownership

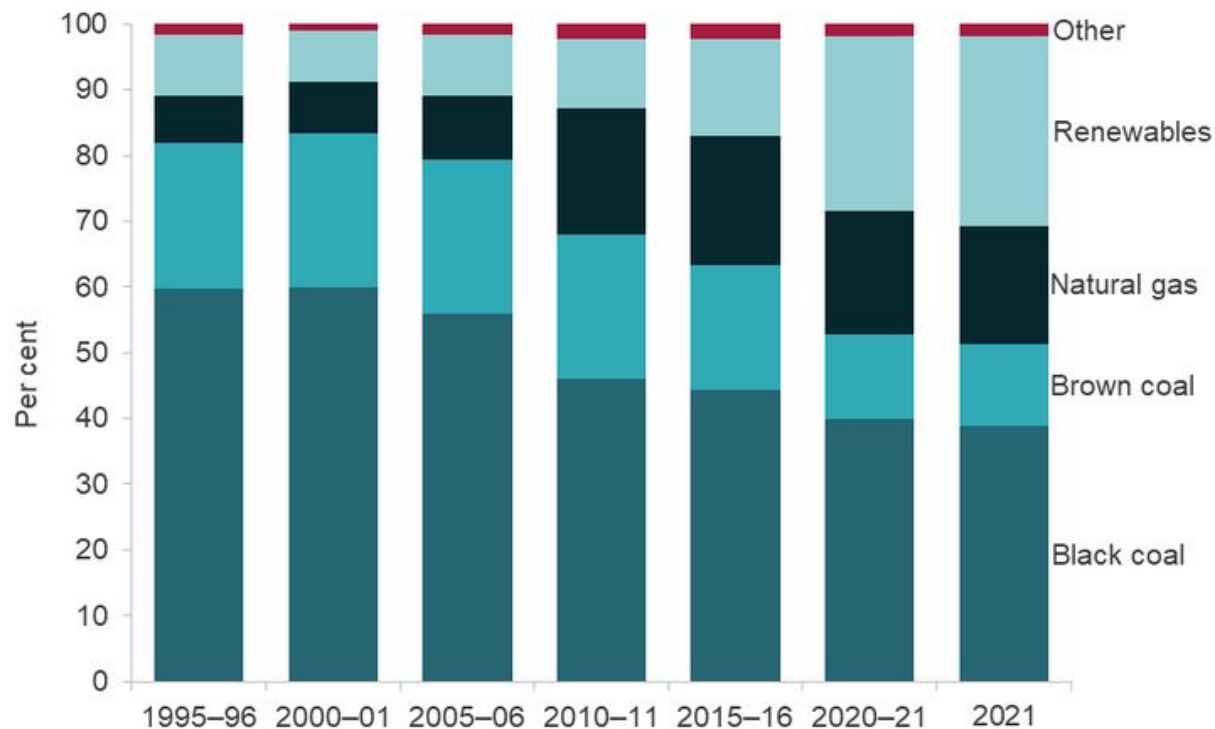
- Private
- Public
- Mix

Associate members



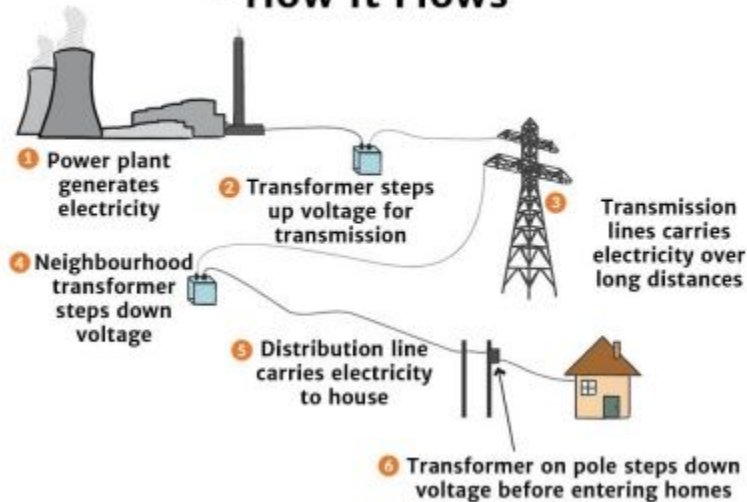
⁴ Network businesses are natural monopolies because the scale and nature of the infrastructure precludes competition from replicating it – it wouldn't make sense for a business to duplicate transmission towers or gas pipes. Electricity transmission and distribution, water and gas pipes generally fall into this category. This is why these businesses are regulated.

Australian electricity generation by fuel mix



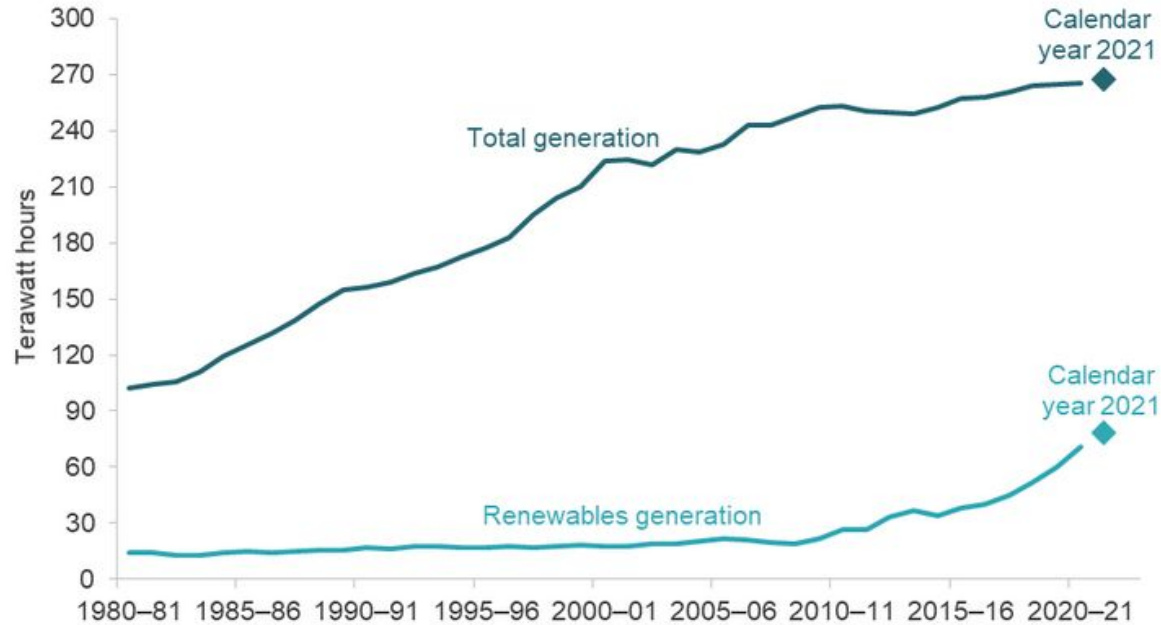
Generation by fuel mix

Transporting Electricity - How It Flows



How the traditional grid operates

Australian electricity generation



Total Generation

Key Terminology

Base Load

Electrical base load is the minimum level of continuous electricity demand that a power grid must meet at all times.

Spinning Reserve

Electrical spinning reserve refers to the backup power capacity maintained by power plants that are already online and synchronized with the grid, but not operating at their full output.

Frequency

In Australia, the electricity network frequency standard is set at 50 Hz. The Australian Energy Market Operator (AEMO) manages frequency control and ensures grid stability.

National Electricity Market (NEM)

The NEM is an interconnected power system that supplies electricity to the eastern and southern regions of Australia, including Queensland, New South Wales, Australian Capital Territory, Victoria, South Australia, and Tasmania.

Obituary for Liddell Power Station

- Commissioned 1971
- Removed from service April 2023
- Capacity of 2GW (Approx)

AEMO warns of NSW power gaps within three years, calls for 'urgent' investment in grid

By energy reporter [Daniel Mercer](#)

Posted Tue 21 Feb 2023 at 1:20pm



The exit of the Vales Point coal-fired power station in 2029

is expected to pile more pressure on NSW. (ABC News: Ben

Australia's biggest coal-fired power plant to shut years ahead of schedule

Federal government warns plant's closure will lead to energy shortages



Origin Energy said the 2.88 gigawatt Eraring power plant was unable to compete with the 'influx of renewables' © AFP via Getty Images

ELECTRICITY RELIABILITY FORECASTS

Percentage of expected unserved energy

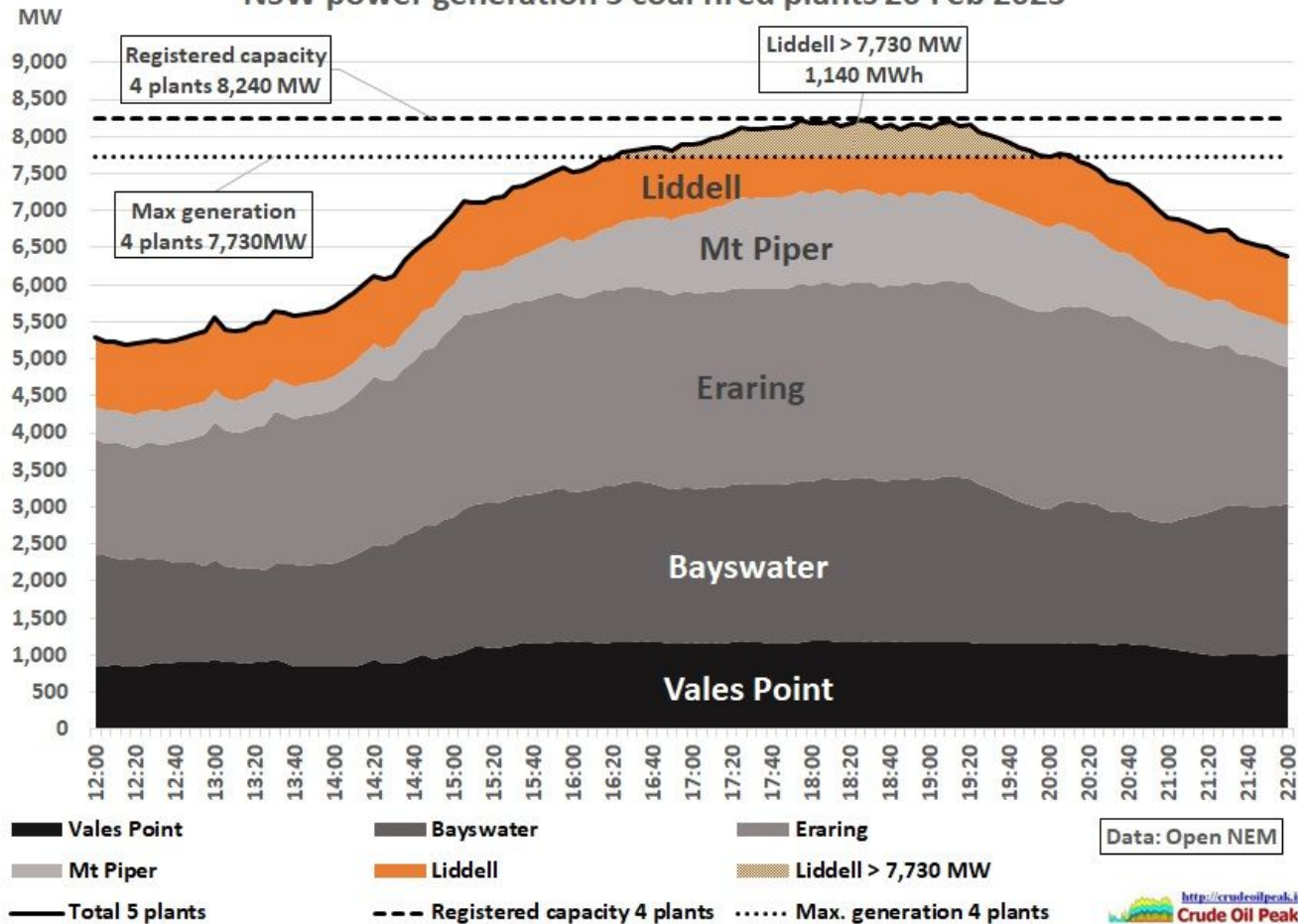


Source: AEMO
Twitter @AlanKohler

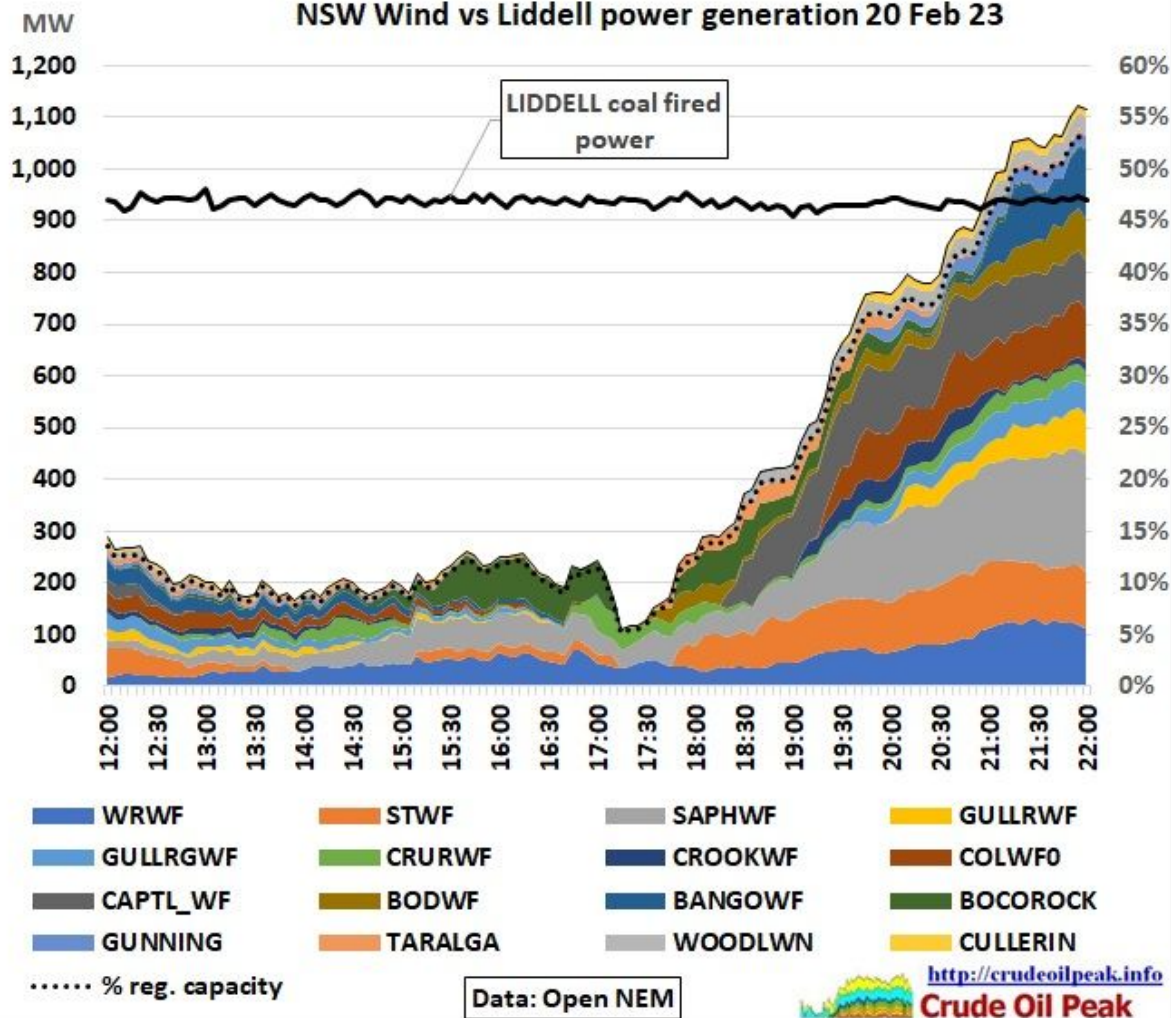


20th February 2023

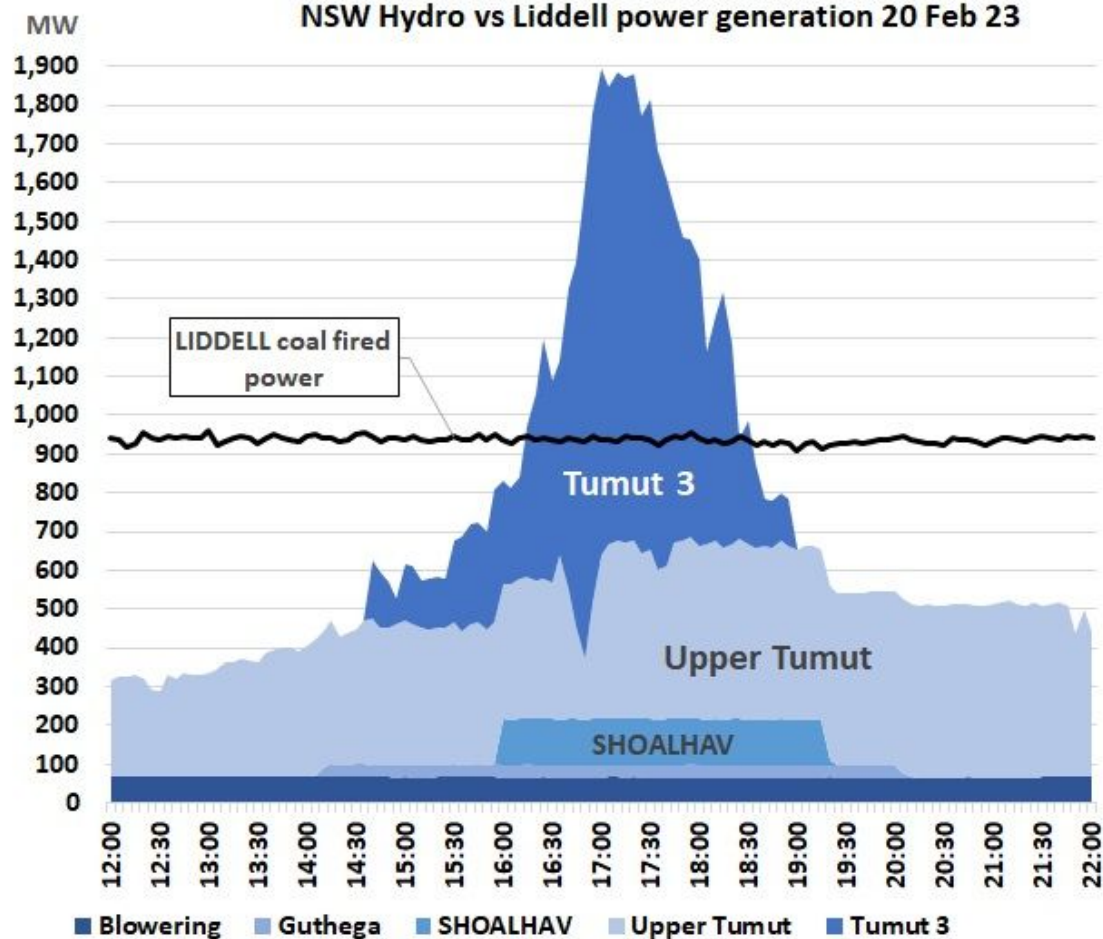
NSW power generation 5 coal fired plants 20 Feb 2023



NSW Wind vs Liddell power generation 20 Feb 23



NSW Hydro vs Liddell power generation 20 Feb 23

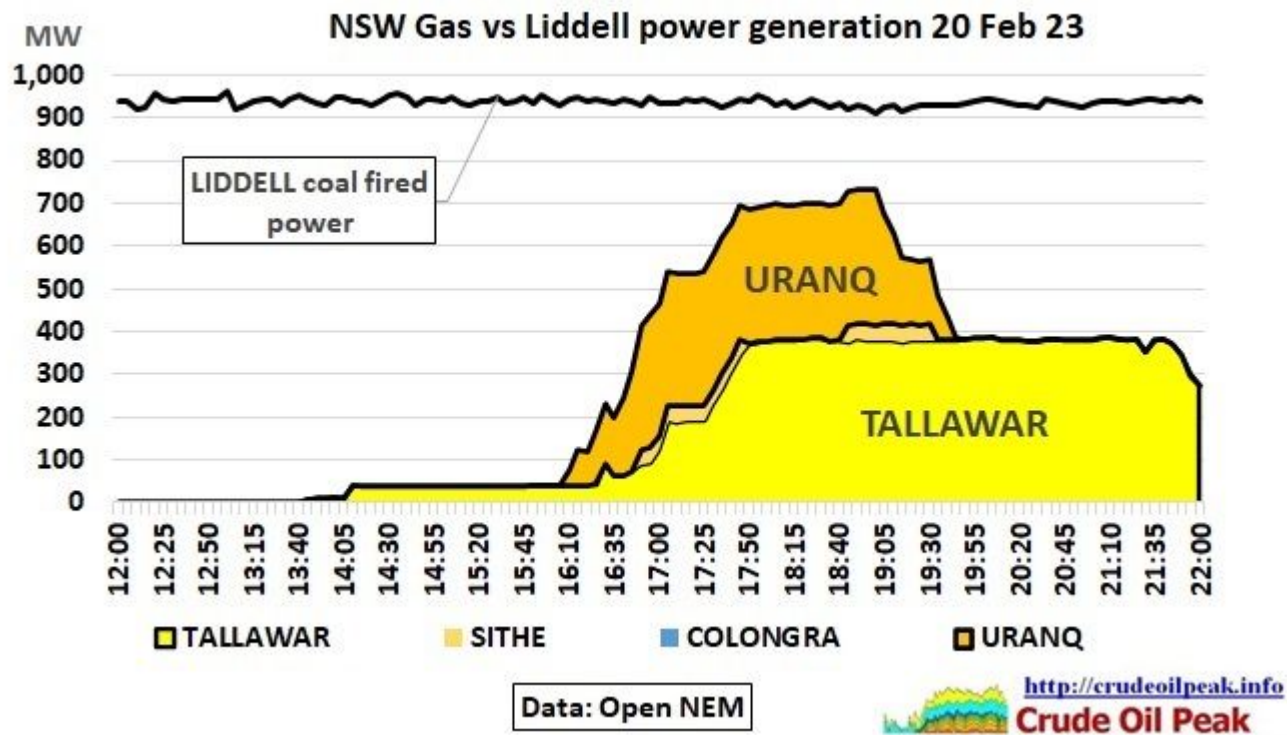


Data: Open NEM

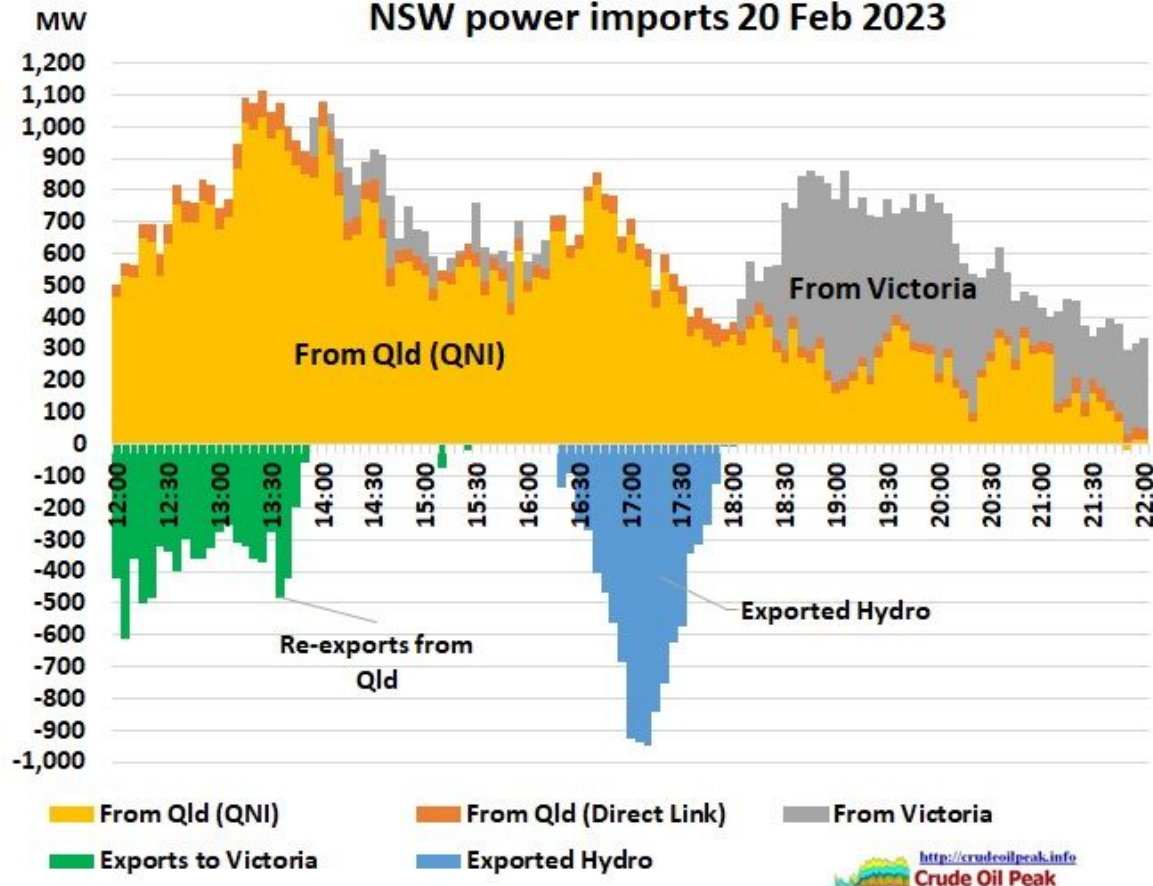


<http://crudeoilpeak.info>

Crude Oil Peak



NSW power imports 20 Feb 2023



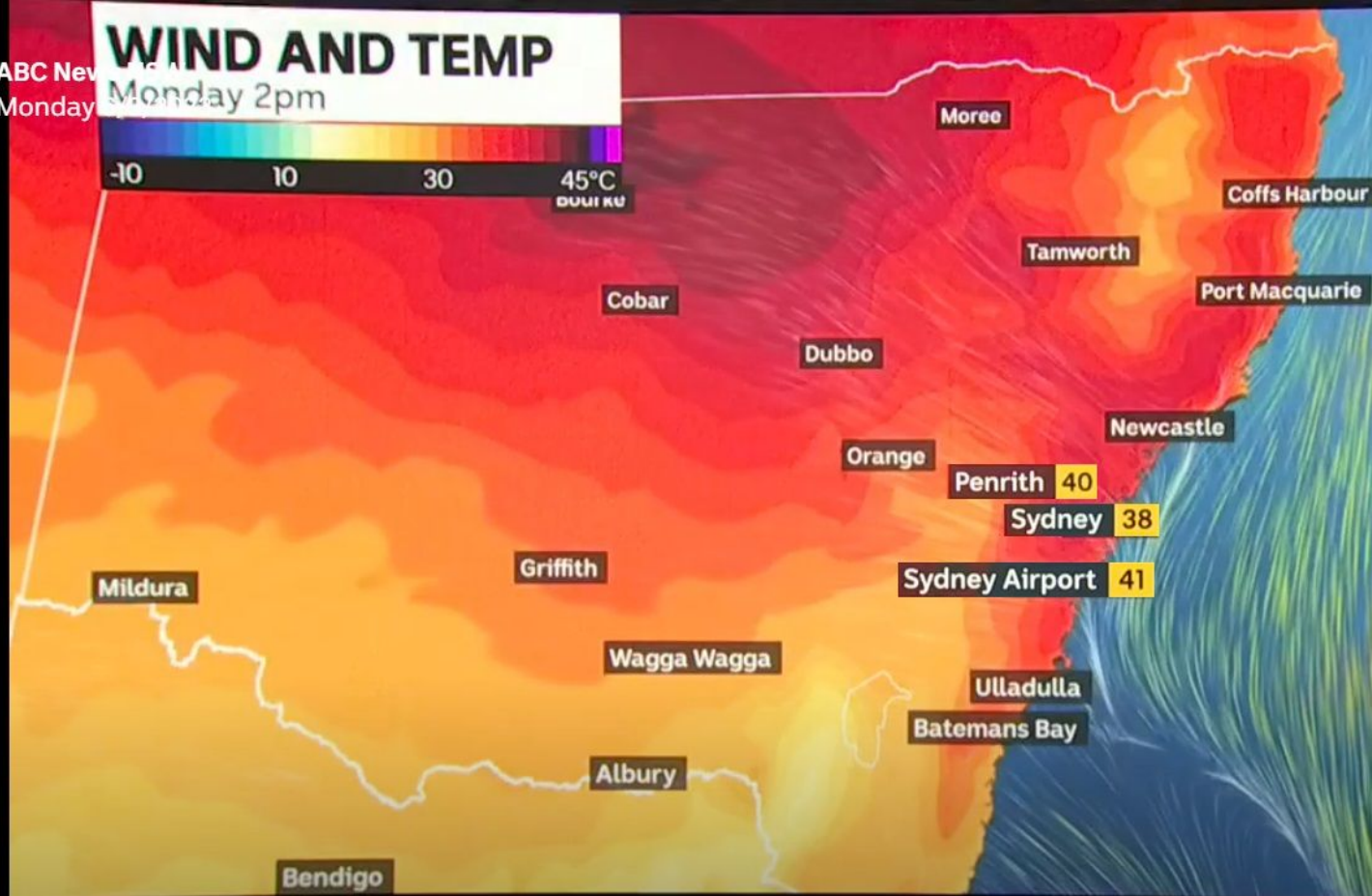
Beware the Ides of March

March 6 - 2023

ABC News
Monday

WIND AND TEMP

Monday 2pm



Dispatch Overview

Price and Demand

Fuel Mix

Renewable Penetration

Average Price

7-Day Outlook

NSW

QLD

VIC

SA

TAS

Chart view

Pre-Dispatch



Mt Piper

Coal (Black)

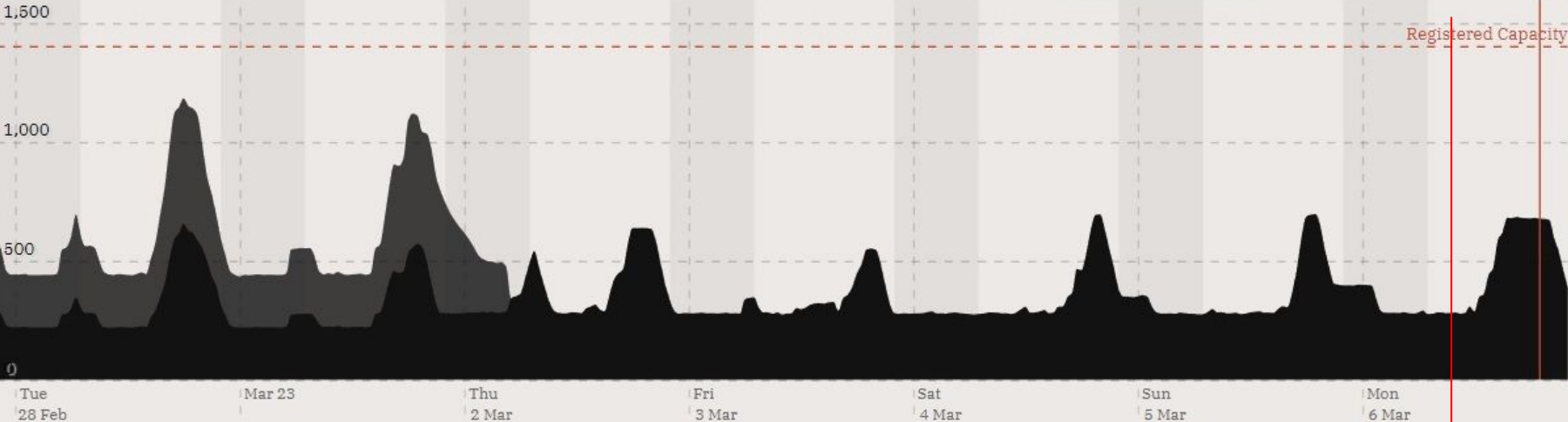
opennem.org.au/facility/au/NEM/MP/?range=7d&interval=30m

Operating since 7 Dec 1998

1D 3D 7D 30D 1Y ALL

5m 30m

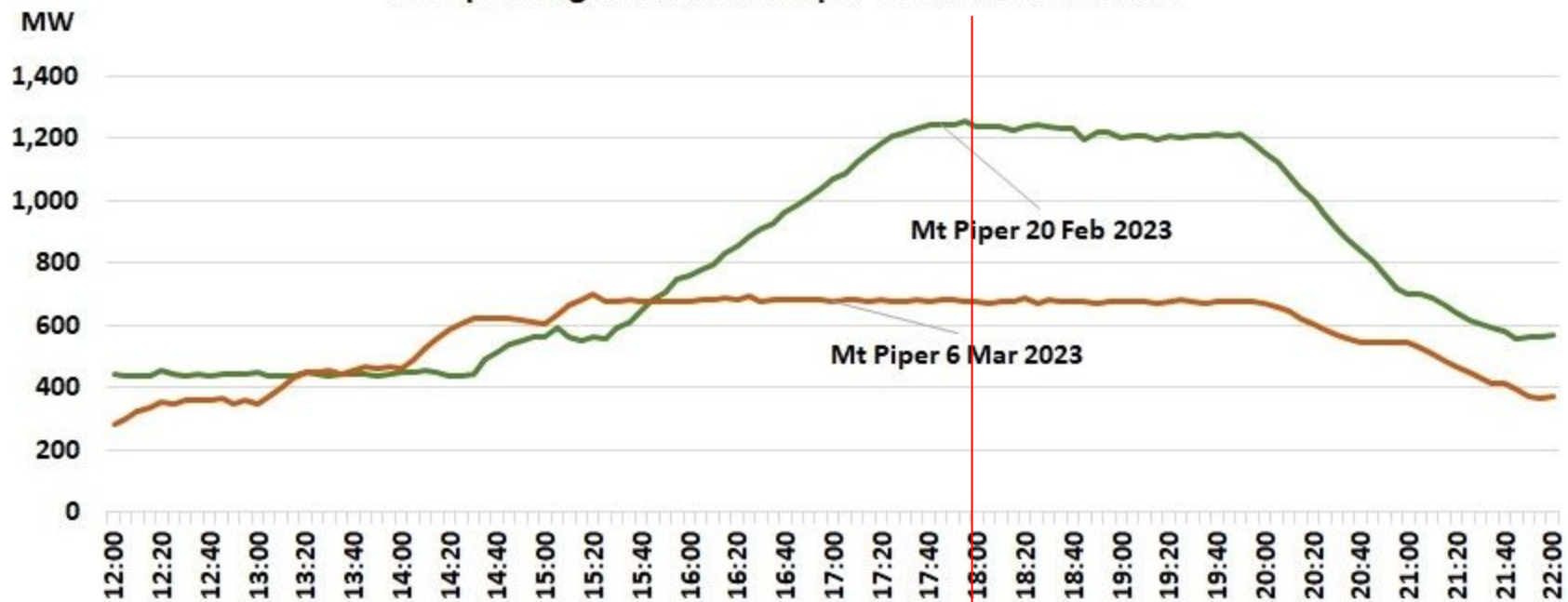
Generation MW



6 Mar 2023, 7:00 PM

Unit	Registered cap.	Emission Intensity	Power	Proportion	Cap. factor
Coal (Black)	MW	kgCO ₂ e/MWh	MW	%	%
MP1	700	909	0		0.0%
MP2	700	909	677	<div></div> 100.0%	96.8%
Total	1400		677		Av. 48.4%

NSW power generation Mt Piper 6 Mar vs 20 Feb 2023



Data: Open NEM



<http://crudeoilpeak.info>

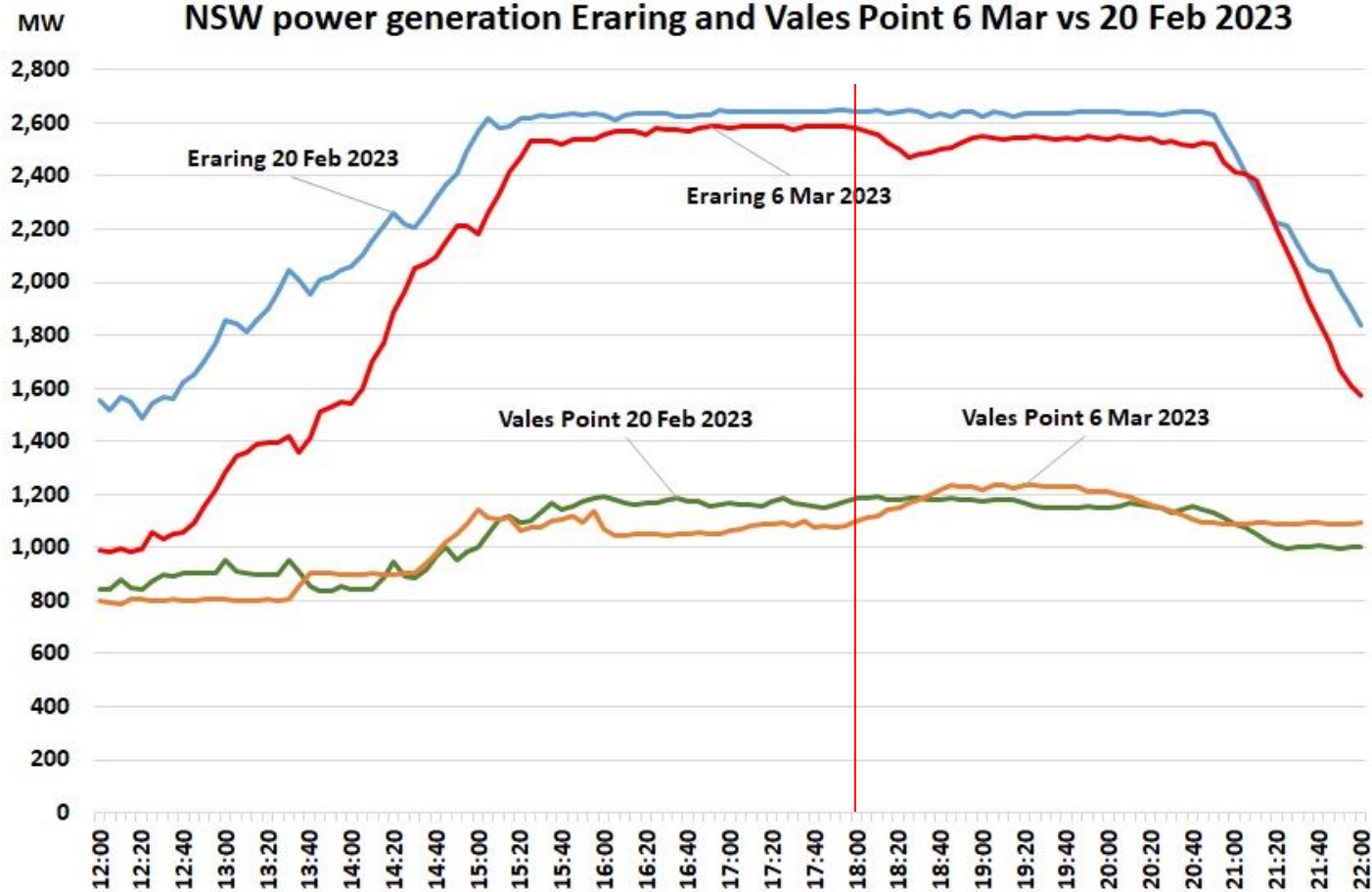
Crude Oil Peak



6 Mar 2023, 5:30 PM

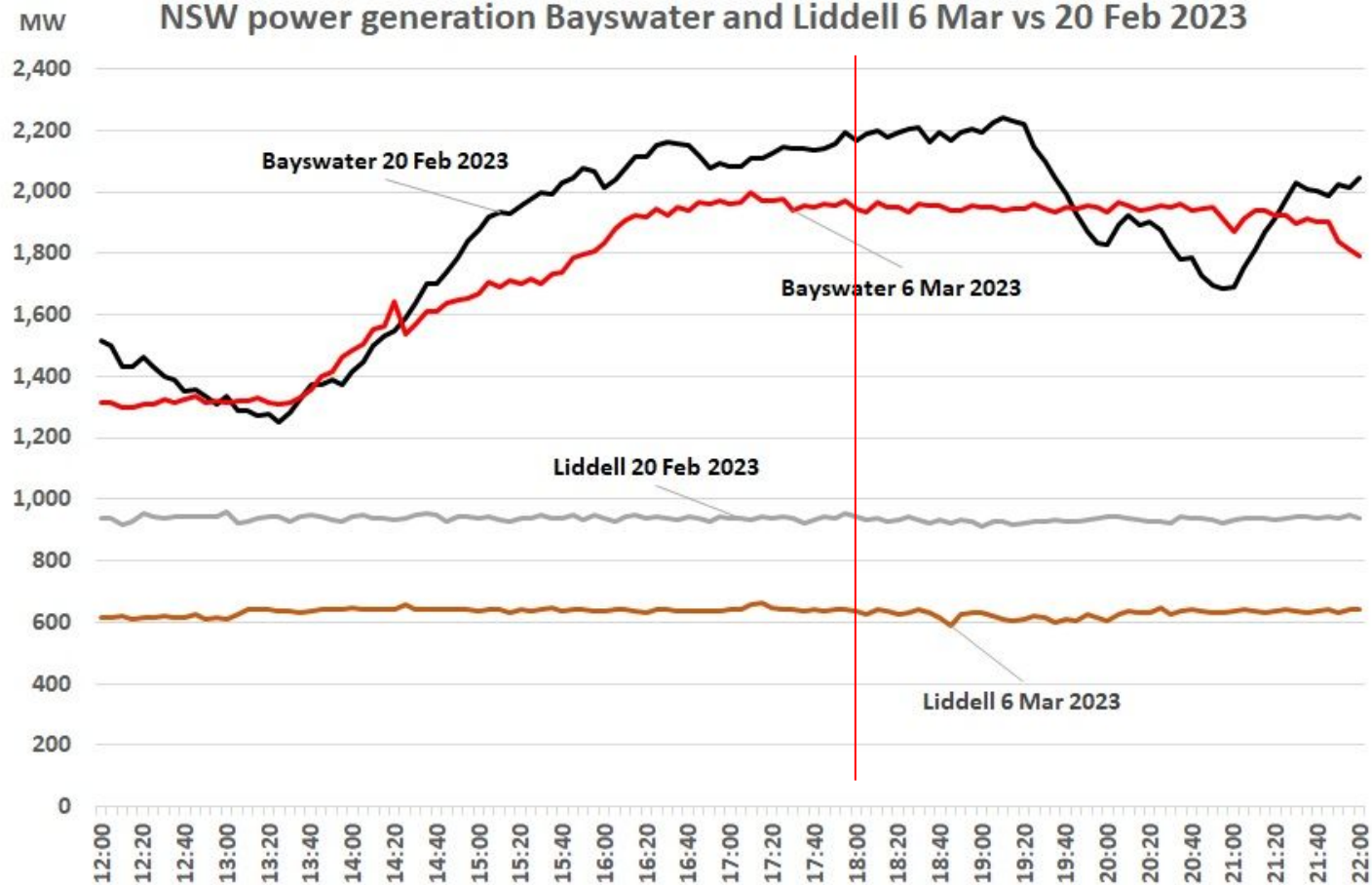
Unit	Registered cap.	Emission Intensity	Power	Proportion	Cap. factor
Coal (Black)	MW	kgCO ₂ e/MWh	MW	%	%
LD01	500	981	325	50.1%	64.9%
LD02	500	981	0		0.0%
LD03	500	981	—		0.0%
LD04	500	981	323	49.9%	64.6%
Total	2000		648		Av. 32.4%

NSW power generation Eraring and Vales Point 6 Mar vs 20 Feb 2023



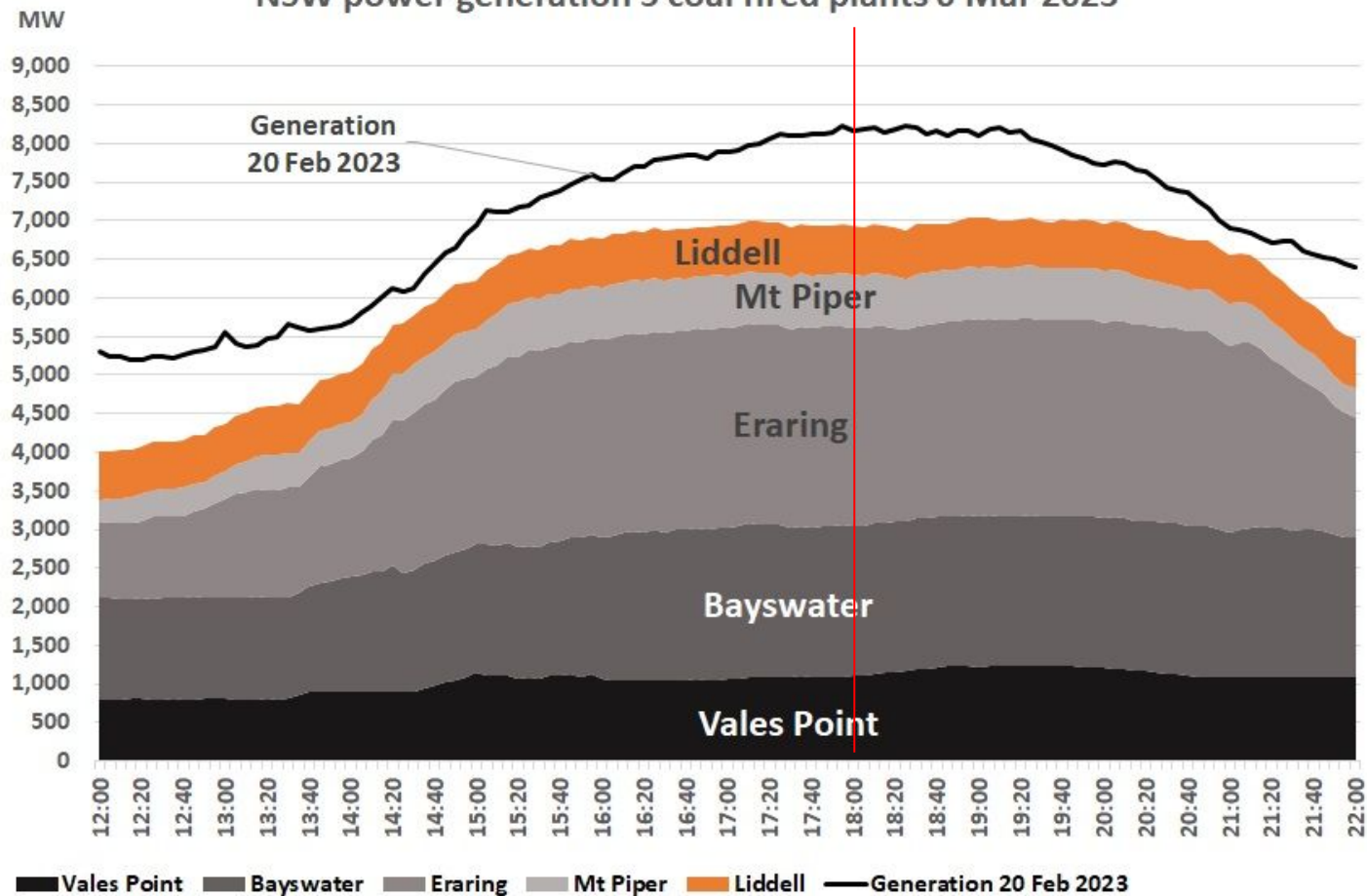
Data: Open NEM

NSW power generation Bayswater and Liddell 6 Mar vs 20 Feb 2023



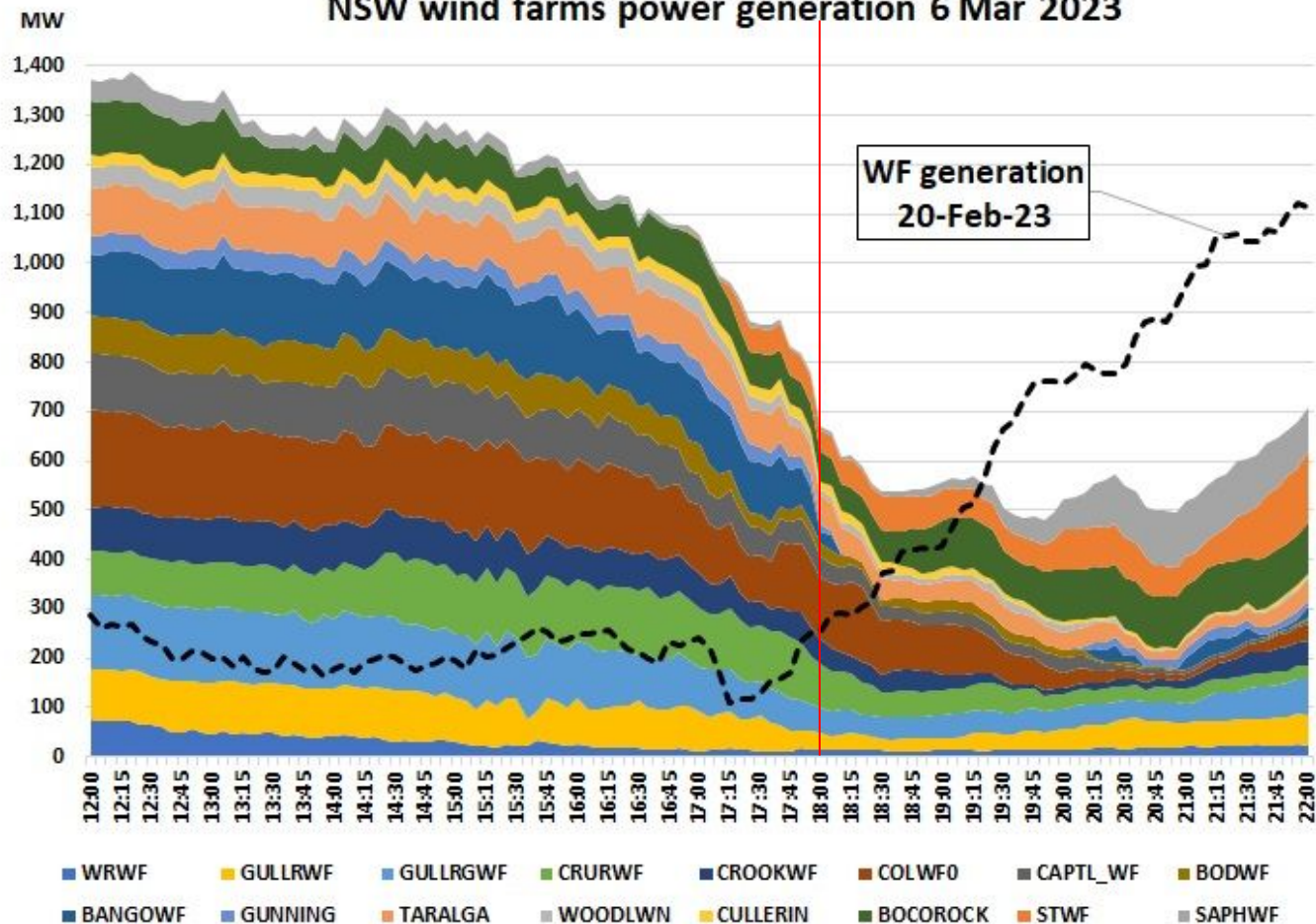
Data: Open NEM

NSW power generation 5 coal fired plants 6 Mar 2023



Data: Open NEM

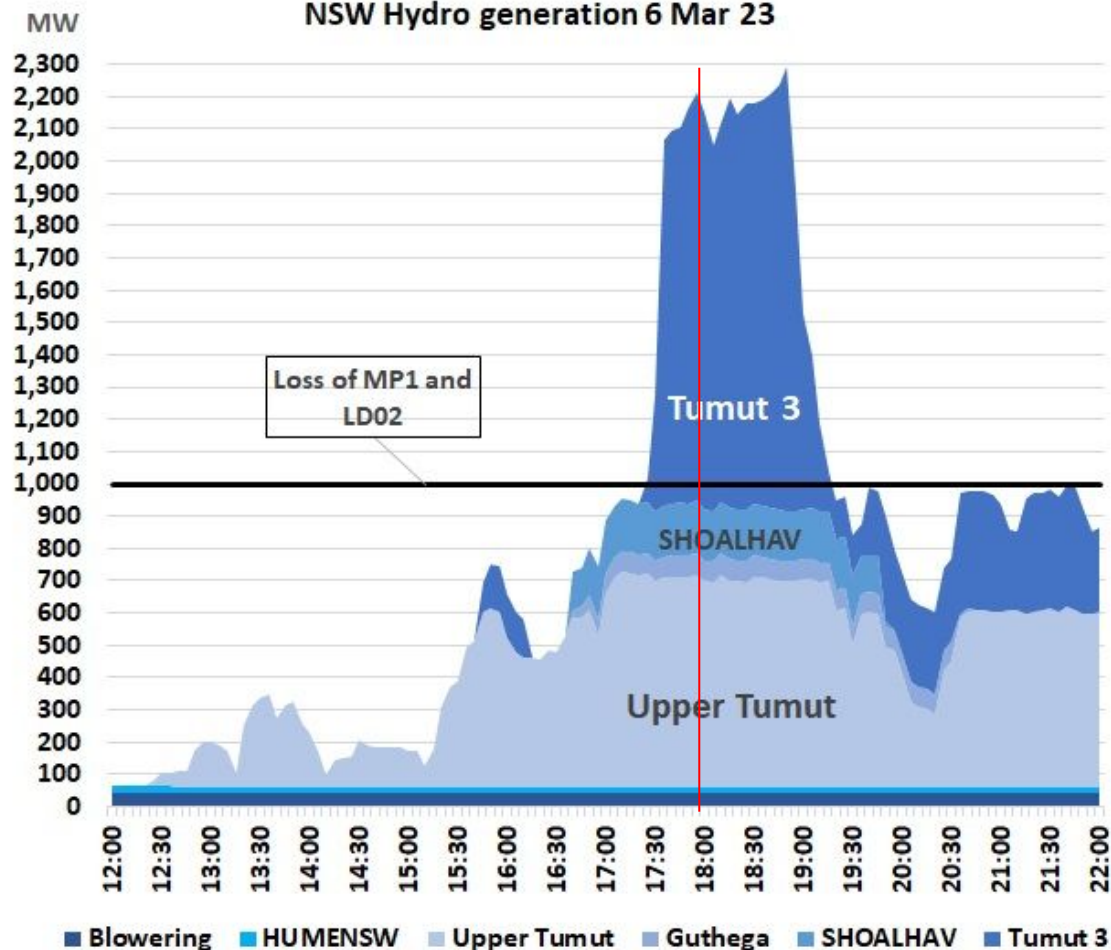
NSW wind farms power generation 6 Mar 2023



Data: Open NEM

Help me Obiwan-Kenobi!

NSW Hydro generation 6 Mar 23



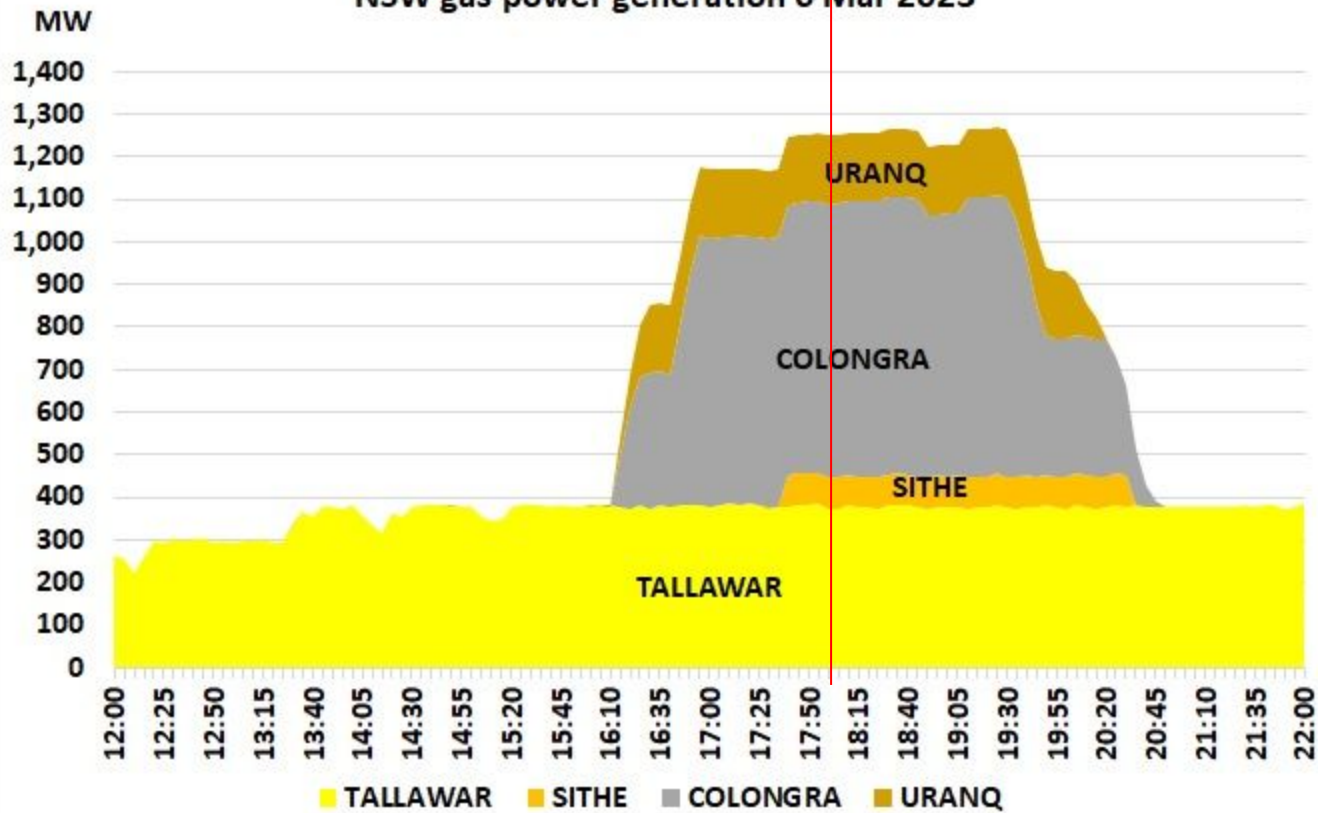
Data: Open NEM



<http://crudeoilpeak.info>

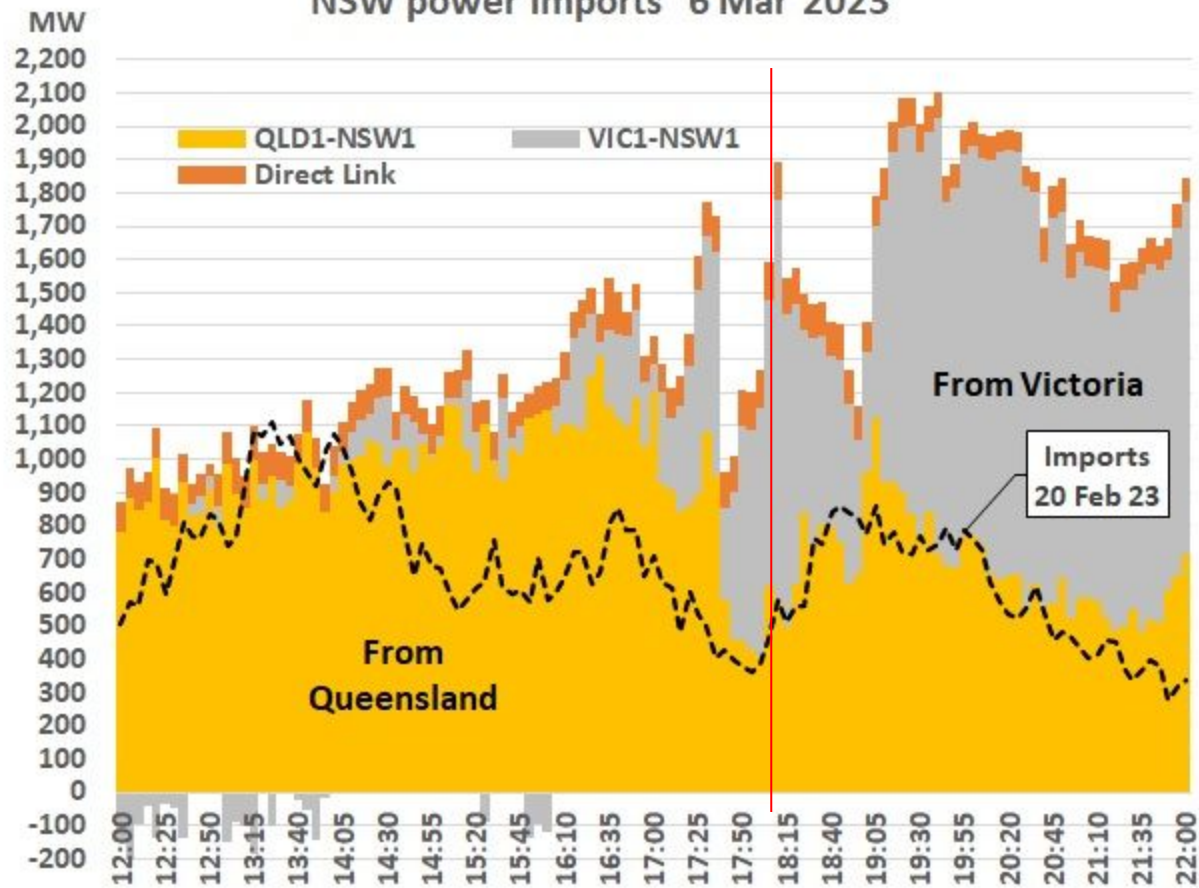
Crude Oil Peak

NSW gas power generation 6 Mar 2023



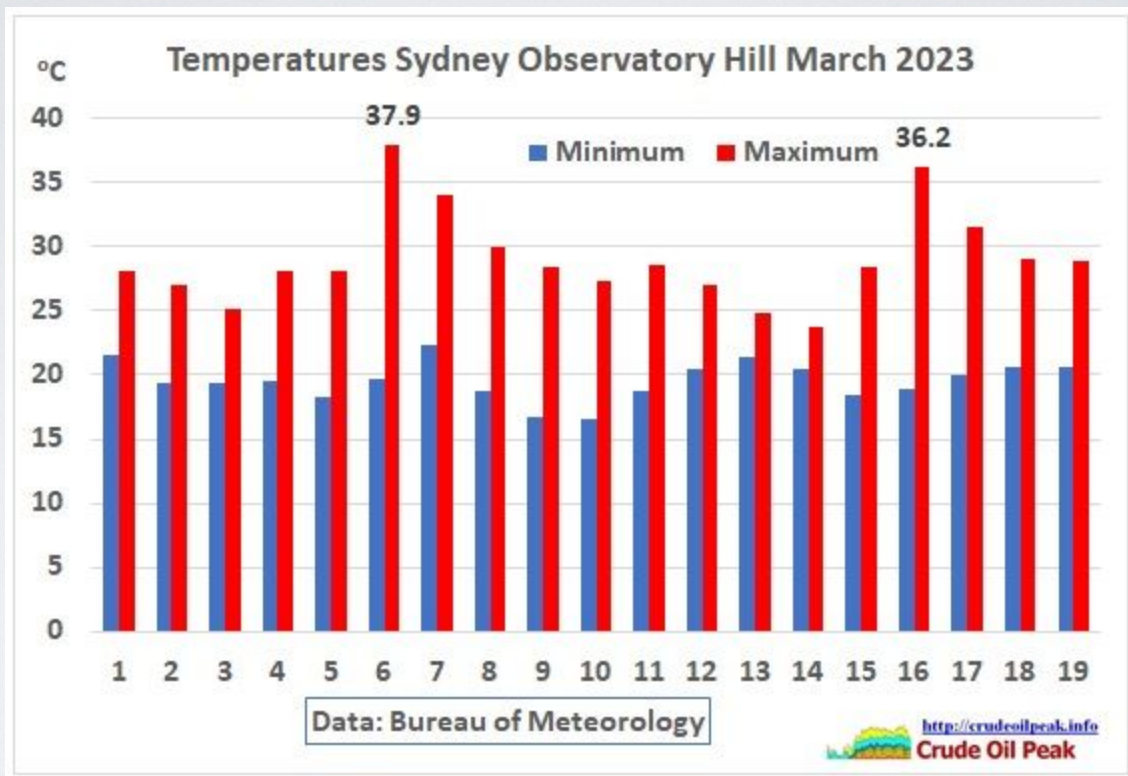
Data: Open NEM

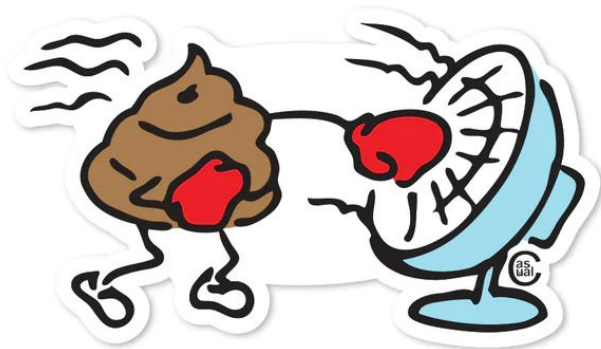
NSW power imports 6 Mar 2023



Data: Open NEM

March 16 - 2023





106711 MARKET INTERVENTION | 16/03/2023 05:31:23 PM

Direction - NSW Region 16/03/2023

AEMO ELECTRICITY MARKET NOTICE

Direction - NSW Region 16/03/2023

In accordance with section 116 of the National Electricity Law, AEMO has issued a direction to a participant in the NSW region. For the purposes of the National Electricity Rules this is a direction under clause 4.8.9(a).

The direction was necessary to maintain the power system in a secure operating state.

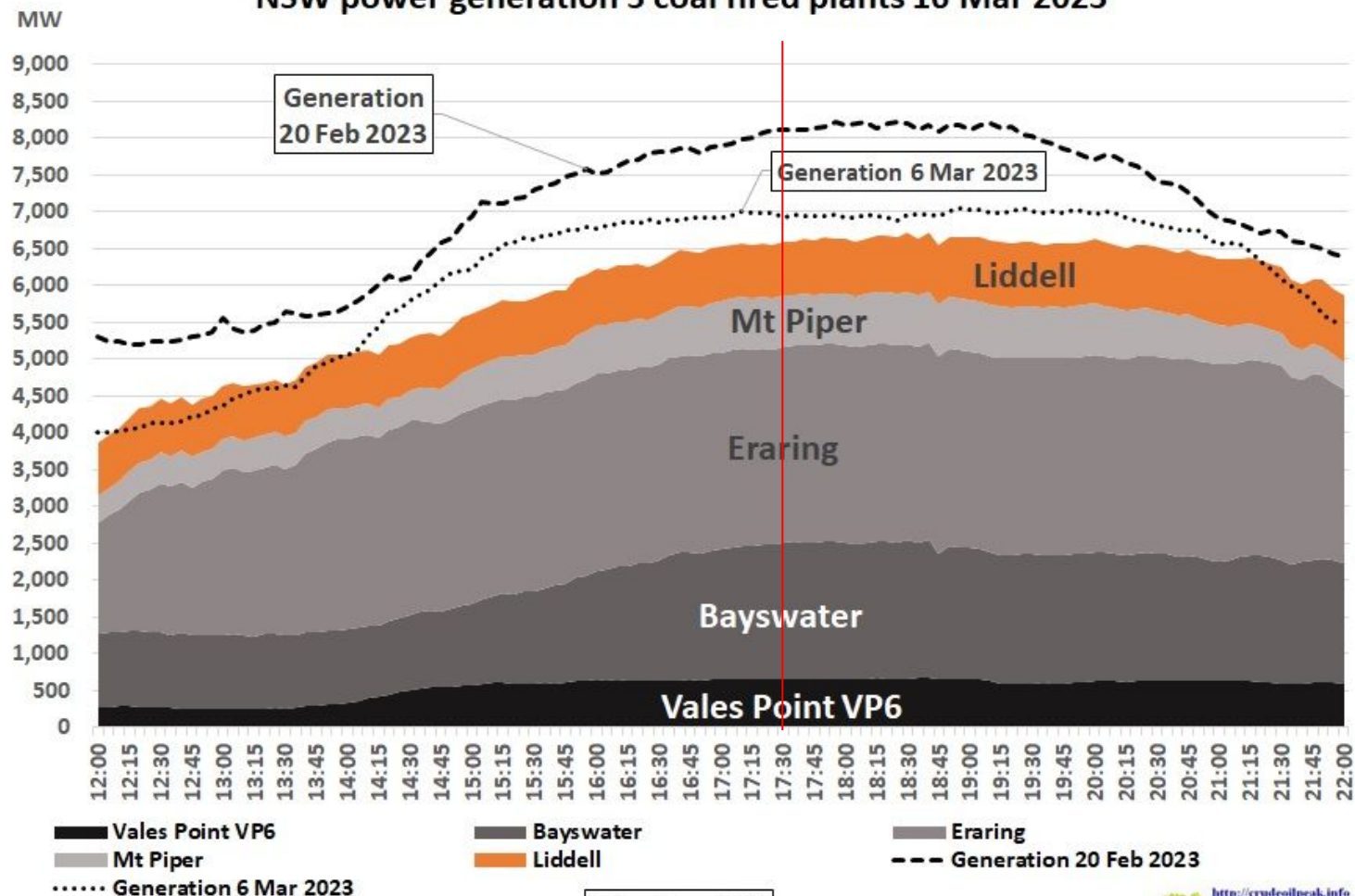
AEMO may issue or revoke additional directions in order to meet the current requirement, unless sufficient market response is provided. A further market notice will be issued when all directions related to this requirement have been cancelled.

The issue of the direction commences an AEMO intervention event. AEMO declares all trading intervals during the event to be intervention trading intervals, commencing from the interval ending 1735 hrs on 16/03/2023.

Intervention pricing does not apply to this AEMO intervention event.

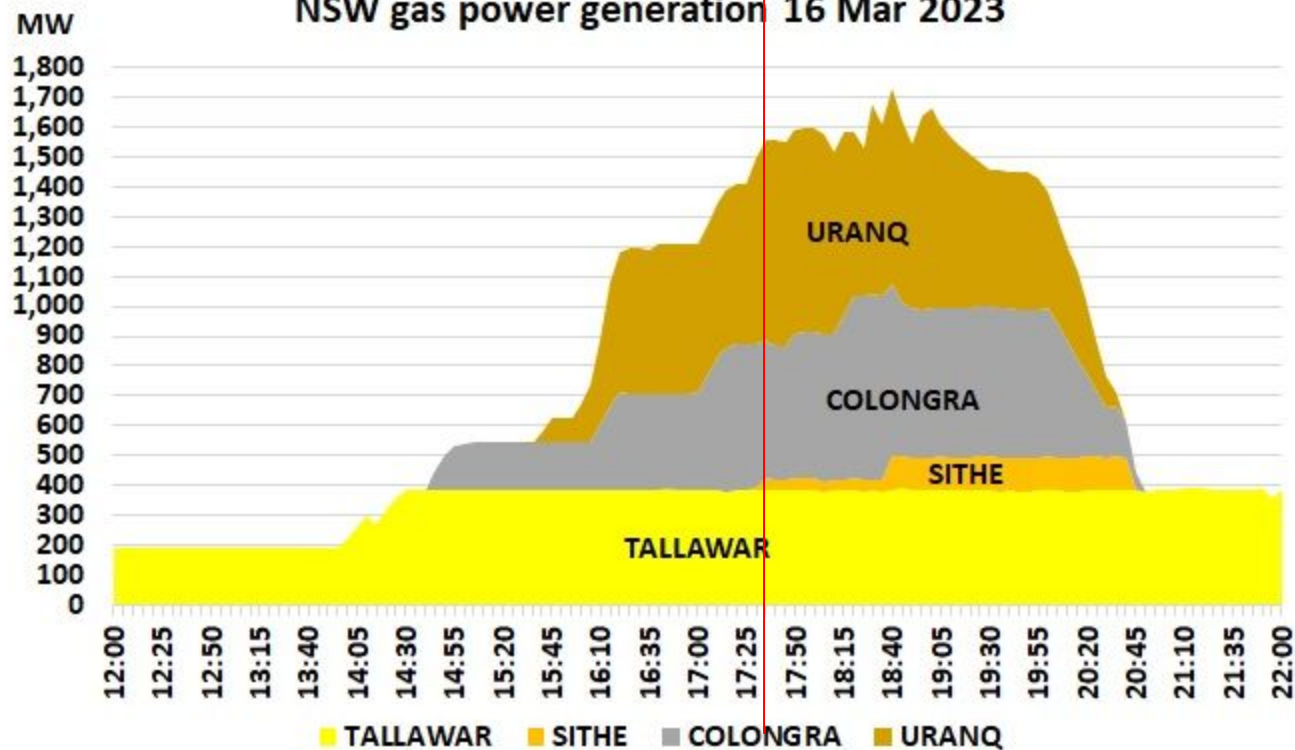
Manager NEM Real Time Operations

NSW power generation 5 coal fired plants 16 Mar 2023



Data: Open NEM

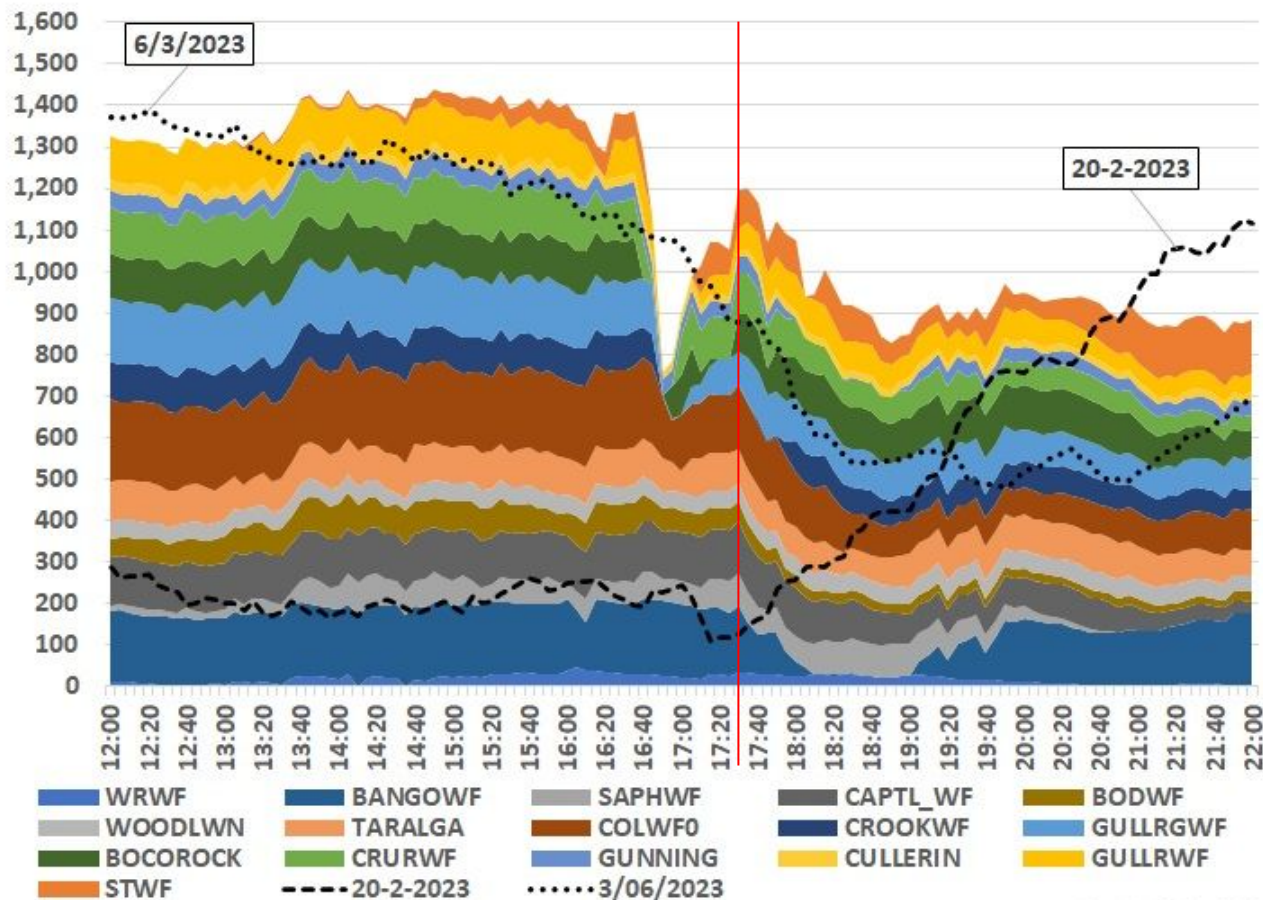
NSW gas power generation 16 Mar 2023



Data: Open NEM

MW

NSW wind farms power generation 16 Mar 2023



Data: Open NEM

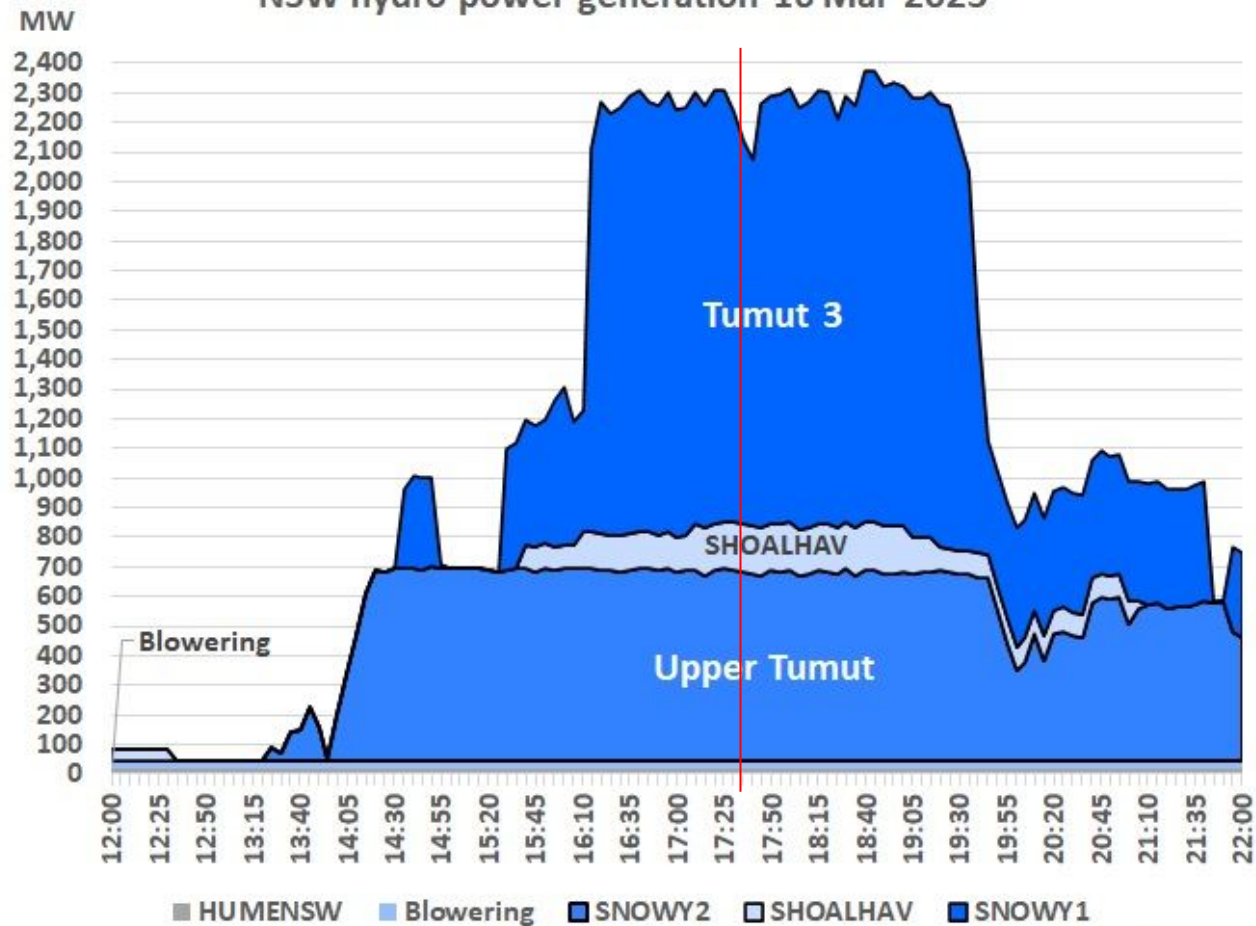
Fire near Crookwell in the NSW Southern Tablelands upgraded to emergency level

ABC Central West / By [Xanthe Gregory](#) and [Hamish Cole](#)

Posted Thu 16 Mar 2023 at 2:56pm, updated Fri 17 Mar 2023 at 12:19am

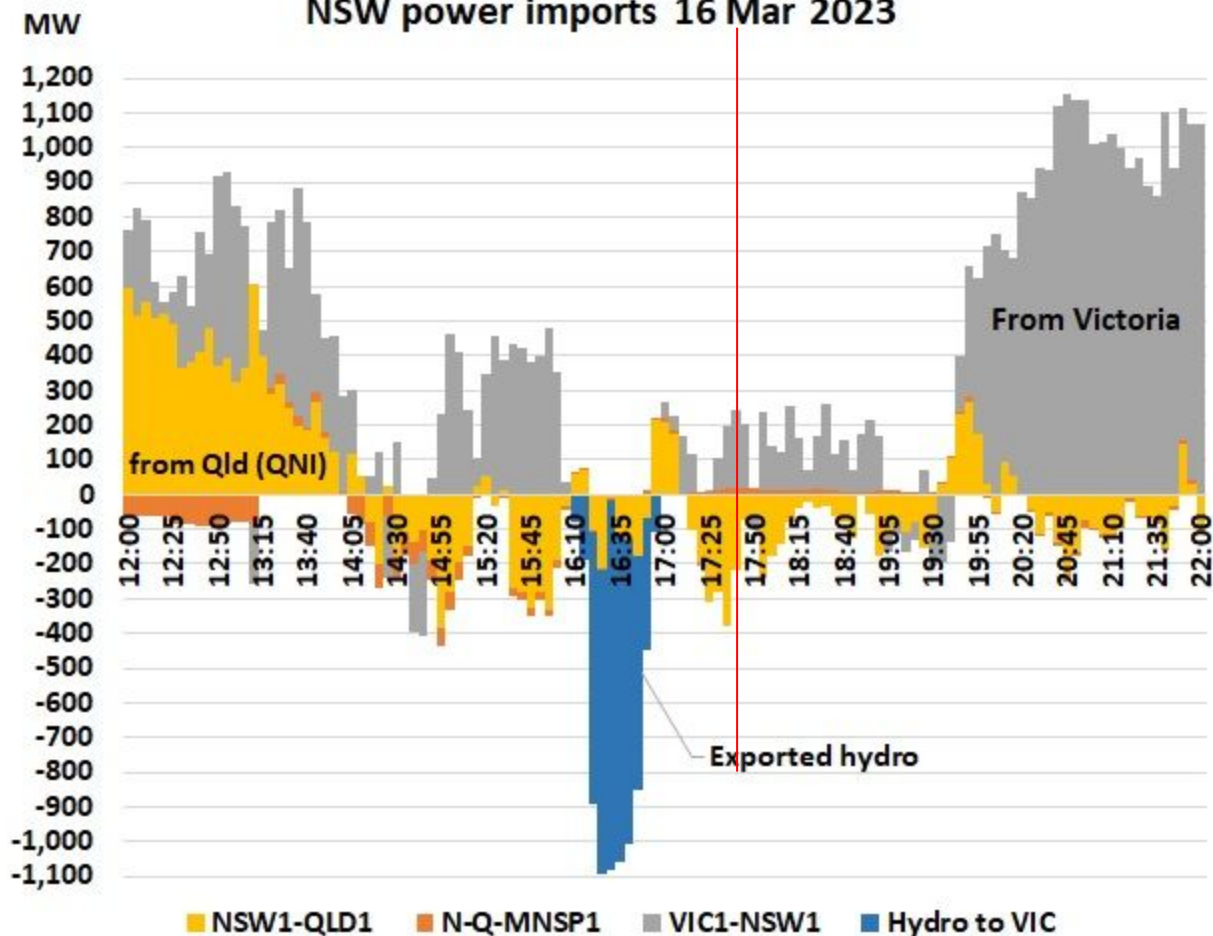


NSW hydro power generation 16 Mar 2023



Data: Open NEM

NSW power imports 16 Mar 2023



Data: Open NEM

Dispatch Overview

Price and Demand

Fuel Mix

Renewable Penetration

Average Price

7-Day Outlook

NSW

QLD

VIC

SA

TAS

Chart view

Pre-Dispatch



AEMO market notices 16 Mar 2023 for New South Wales

<https://aemo.com.au/en/market-notices>

Notice number	Time of notice	Notice	For period	Reserve required (MW)	Reserve available (MW)
106700	4:34 pm	Actual Lack Of Reserve Level 1 (LOR1)	16:00–19:00	1,385	901
106706	5:03 pm	Forecast Lack Of Reserve Level 2 (LOR2)	18:00–18:30	700	682
106708	5:07 pm	INTENTION TO COMMENCE RERT CONTRACT NEGOTIATIONS	18:00–19:00		
106713	5:23 pm	INTENTION TO IMPLEMENT an AEMO INTERVENTION EVENT WITH RERT	18:00–19:00		
106711	5:31 pm	Direction. AEMO has issued a direction to a participant in the NSW region	From 17:35		
106716	5:54 pm	Actual Lack Of Reserve Level (LOR2)	17:50–18:30	700	372
106724	6:38 pm	Cancellation – AEMO Intervention Event – trading intervals	From 18:35		
106726	6:57 pm	pm Cancellation of Actual (LOR2) condition	From 18:55		

RERT=Reliability and Emergency Reserve Trader

NSW power demand and generation 16 March 2023

	Metric	Capacity factor	Remarks
Max temperature	36.2 °C		2 nd highest in March 2023
Max power demand	<u>12,300 MW</u>		700 MW lower than on 6 Mar 2023
Price spikes	\$7,800/MWh		For 1 hr between 17:45 and 18:50 hrs
Generation from coal	6,700 MW	94%	12 units in operation reg. capacity 7,120 MW 3 units with 2,020 MW not in operation
Generation from gas peakers	1,600 MW	94%	<u>Colongra</u> , <u>Tallawarra</u> , <u>Uranquinty</u> No gas/storage shortage
Generation from hydro	2,300 MW	93%	Pumps have replaced lost <u>water</u> by only 50% x 80% = 40%
Generation from wind	1,200-900 MW	56-42%	Afternoon decline, evening stable
Power imports	1,100 MW 200-300 MW		From Victoria, late at 20:40 hrs, wind-dependent and in competition to South Australia From Queensland during peak period very limited due to power generation maxed out

...

Green | New Energy

Australia Is Quitting Coal in Record Time Thanks to Tesla

Elon Musk helped accelerate a transformation of the country's electricity grid to replace fossil fuels with clean power — now it's a testing ground for global climate action.

By James Fernyhough

April 4, 2023, 10:00 PM UTC

Tesla big battery fined for failing to deliver promised capacity when coal plant tripped

[Giles Parkinson](#)

28 June 2022

44





Environment



Aa

2 minute read · April 21, 2023 3:53 AM GMT+10 · Last Updated 5 days ago

World could face record temperatures in 2023 as El Nino returns

By Kate Abnett



Australia at risk of electricity supply shortages as renewable projects lag behind coal plant closures

Successive La Niñas have eased demand but, with many renewable and storage projects now delayed, the energy market operator has revised its projections

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- [Get our morning and afternoon news emails, free app or daily news podcast](#)

Peter Hannam

Tue 21 Feb 2023 01.00
AEDT



WHAT SHOULD I DO DURING LOAD SHEDDING?

MAKE USE OF SURGE PROTECTION

The greatest cause of damage to equipment from a power outage is from electrical surges. Installing a surge protection device can help minimise some damage in unforeseen situations when the power goes off or is restored.



BACK IT UP

When working on a computer, back up important data and save your work incrementally so that you don't lose your work/files during load shedding.



ELECTRIC FENCING

To ensure that your electric fencing continues to function during load shedding, your electric fence and electric gate battery should have a back-up battery.



UNPLUG YOUR CABLES

It is vital to unplug computer power cables from the sockets, as well as telephone cables from the modem when there is an imminent power outage. This applies to all sensitive equipment.



PORTABLE MODEM

You can either use a 3G internet dongle or your smart phone as a modem for your laptop to keep you connected to the internet during load shedding.

FULLY CHARGE YOUR BATTERIES

Make sure that your laptop battery is fully charged and that your smart phone and tablet have enough battery life.



BE VIGILANT

Ensure that you are especially alert when arriving at or leaving your home in the evenings, as the street lights and your outside lighting will not be functioning during the load shedding process.



LIGHTING

A battery powered torch is essential in every household. Candles and matches must be used with care as they can cause fires.



FIRST-AID KIT

Make sure your kit is stocked and store it in an easily accessible place for the family to reach it during a power outage.



INVEST IN A UPS

A UPS not only acts as a back-up battery for your PC in the event of a power failure, but it also regulates the amount of power that your computer receives. Use as per product instructions. Do not reverse the feed; this is dangerous as your earth leakage will not function.



EIUG
Electricity Users Group
of South Africa

BDO

Eskom

Takeaways

- You are on a narrow highway, going up a mountain with no shoulder, trying to pass a large double trailer truck.
- Would you want a sports car that can accelerate quickly, that has lots of extra (unused) engine capacity
- Or a 4-knot-shit-box that is redlining already in 5th gear with the AC and radio off?
- Most of the time the small car is fine, but under the right circumstances things can get interesting...



Questions?



- <https://www.aemo.com.au/Energy-systems/Electricity/National-Electricity-Market-NEM/Data-NEM/Data-Dashboard-NEM>
- https://www.google.com/maps/d/u/0/viewer?msa=0&mid=IPhfXhtGCj_T0skcd7gVJa_AKRm4&ll=-36.0005665794753%2C146.5957492473965&z=6
- <https://www.energymatters.com.au/energy-efficiency/australian-electricity-statistics/>
- <https://opennem.org.au/energy/sa1/?range=7d&interval=30m>